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Problems in Marketing Utah Fruits and Vegetables

Uniform Grade Standards, Standard Types and Sizes of Containers, and Consistent Sales Program
Essential to Successful Marketing of Utah Products

THE fruit and vegetable industry in Utah and other areas has been going through a period of adjustment. Overplanting of some kinds and varieties, increased distribution costs, changes in consumer demands for quality goods with special packaging and services, and the violent changes in prices and consumers' incomes are the major factors affecting fruit production and income. Although the problems of adjustment have been severe in most fruit areas, indications are that they have been more acute in sections farthest from consumer markets, especially in Utah where transportation costs are higher than for most competing areas.

During the past year, studies have been conducted by the Department of Agricultural Economics, cooperating with growers' committees and state and federal agencies, to determine the economic position of Utah fruits and vegetables on various markets, and the efficiency of marketing agencies handling these products from this state.

A part of this investigational work was the collecting of information regarding the economic position of Utah fruits and vegetables on out-of-state markets. This information was obtained largely by interviewing brokers, commission men, wholesalers, and retail handlers of fruits and vegetables, and by observing Utah products on the markets in comparison with products from competitive production areas. Another phase of the study was analyzing the efficiency of the business organizations which marketed most of the 1941 crop of peaches and cherries. Attention was also given to the volume of Utah's production of fruits and vegetables and its distribution. A brief summary of the findings of these studies follows:

By W. PRESTON THOMAS,
GEORGE T. BLANCH, and
A. L. STARK

Summary of Findings of Investigational Work on Out-Of-State Markets

(1) The flavor, color, texture and general eating qualities of Utah fruits and vegetables compare favorably with fruits and vegetables from competing areas.

(2) Utah fruits are usually smaller in size than the fruit from competing areas.

(3) Fruits and vegetables of a specified grade coming from Utah are considered by the handlers in the terminal markets as not being the equal in quality of fruits and vegetables of similar grade coming from most other areas.

(4) The limitation to the sale of fruit and vegetables from Utah in many areas is imposed by the quality of the packing—not the quality of the product. The weaknesses of the packing most often cited were:

(a) Lack of uniformity in the size and ripeness of fruit that is packed in each package and in each car.

(b) The fruit used in facing the package is often much better than that in the body of the package.

(c) Packages are not always completely filled, resulting in short weights and a loose pack which destroys the face.

(5) Containers were often inadequately labeled.

(6) Bushel baskets were often used when the trade prefers boxes.

(7) Much fruit, particularly peaches, is damaged in transit through the use of baskets. This results partly from the nature of the basket, partly from improper lidding, and sometimes from improper or inadequate bracing and loading of cars.

(8) Cherry varieties are often improperly labeled. Several other varieties were labeled as Bings.

(9) Too many different sizes of cherry containers are used.

(10) The interval between loading and sale is often too great with the result that the produce has greatly deteriorated before reaching the market.

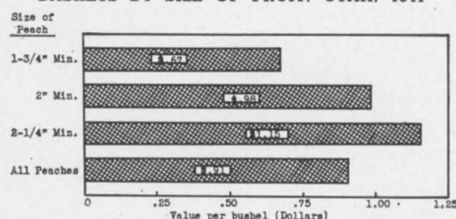
(11) As measured by grade and quality standards, Utah produce was found to be inferior and, in general, the sale price was lower than that of produce from other areas.

(12) The total production of Utah fruits and vegetables is relatively small and marketing is made difficult because the production is scattered over a wide area with little tendency for concentration of a particular kind of fruit or vegetable in a given area.

(13) The distribution of Utah fruits and vegetables tends to be widely scattered and with little tendency toward concentration in any area. This mitigates against the development on the part of consumers or dealers of any preferential demand for Utah products, and also against efficiency in the performance of marketing services.

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NET PRICES RECEIVED FOR PEACHES IN BASKETS BY SIZE OF FRUIT, UTAH, 1941



Cooperative marketing associations received in 1941 an average price of 91 cents per bushel in baskets, f.o.b. loading station. The average price received from 2 1/4 inch minimum peaches was \$1.15; for 2 inch minimum, 98 cents; and for 1 3/4 inch minimum, 67 cents

RESTRICTIONS on the use of rubber are focusing public attention on new plants from which this material may be obtained. Numerous requests have come to the Station asking about the possibilities of the cultivation or use of such plants in Utah.

In 1940, 97 percent of the rubber used in the United States came from Southeast Asia and the Dutch East Indies. However, even before the war threatened these sources, attempts were made by rubber interests in the United States both to grow rubber trees, and to find plants with a comparable rubber content that will grow in the temperate climate of the United States.

In March, 1923, Congress appropriated \$500,000 to be used by the Department of Commerce for investigating the possibilities of developing the rubber industry in the Philippines and Latin America. An American company has also made extensive developments in Liberia, Africa.

The Bureau of Plant Industry has a division on rubber plants, and for the past few years this division has been making extensive investigations in the producing of rubber plants in Central and South America. Several shipments of budded rubber stumps have been brought from the Philippine Islands and the Dutch East Indies. A large nursery and experimental station have been set up in Costa Rica for the purpose of producing these plants. Although the rubber tree is a native of South America, certain diseases have hampered the economical production there. One of the objectives in the research of the Bureau of Plant Industry is to grow large numbers of varieties or strains of the rubber trees with the hope of finding some that are resistant to the disease and that can be grown economically in the Western Hemisphere.

There is always the possibility, however, that these sources may become inaccessible through war as have the Far Eastern sources. Then, too, this supply is not nearly sufficient to meet the demand.

Scientists have been working on development of synthetic rubber from coal by-products, petroleum, starch, and other substances for the past twenty years. The Northern Regional Research Laboratory at Philadelphia is investigating the production of rubber from starch through fermentation. They are also attempting to develop a rubber extender. Synthetic rubbers have been developed, but they are still expensive to produce. Plant capacity until recently has been sufficient to supply but 1½ percent of the needs. Factories now authorized and those

RUBBER FROM WESTERN DESERT PLANTS

Of Native Utah Plants, Rabbitbrush has Best Possibilities for Rubber Production

planned will be able to produce 25 percent of normal needs by the end of 1943.

Although there are nearly 500 rubber-producing plants, only a few of them contain rubber in a sufficient quantity to make collection profitable. There are a number of these plants which are adapted to various parts of the United States.

Rubber from the guayule plant is already being produced commercially in the Salinas Valley in California, and a few other places. This industry is now being expanded as rapidly as possible. Field plantings of 2,000 acres have been made this spring from nursery seedlings on hand.

Investigations have been made regarding the adaptability of guayule for growth in Utah. It has been found that the plant will not survive where temperatures are subfreezing for long periods of time. Consequently, there is but a small area in Washington County with a climate suitable for the production of guayule and then not without irrigation. Irrigation would greatly increase production costs.

The possibility of obtaining rubber from Utah vegetation has not been investigated enough to make a definite statement as to its practicability. Literature and observations combine to indicate the advisability of harvesting naturally growing plants rather than growing plants under cultivation. Most species produce more volume and a higher rubber content under cultivation, and selection offers much hope for increasing the rubber yield. However, the present emergency demands rubber now.

Rabbitbrush, *Chrysothamnus nauseosus*, is the most hopeful source of rubber in Utah among the naturally growing plants. It grows from 3 to 10 feet high and in rather pure stands. It is widely distributed on the desert ranges. Large areas exist on the alkaline flats of Sevier Valley, especially between Panguitch and Fayette, northern Tooele Valley south to Vernon, Tintic Valley, Rush Valley, Juab Valley, Price and Green River Valleys. Northwestern Utah varieties contain little or no rubber. Uinta Basin species are low in rubber and scattered. Important areas lie also in southwestern Utah. It is of no particular value to the ranges, and stockmen would be pleased to have it collected. The exact amount that could be harvested is not known as no survey has been made, but it would probably be in the millions of tons.

Rubber occurs in *Chrysothamnus* in the solid form (not latex) known as chrysil,

and is of better quality than that of most native plants including guayule, though it is not as high quality as ordinary rubber. Contents as high as 6½ percent have been found but the plants average about 2.5 to 3.0 percent free from all resins, and other impurities. However, in general, Utah plants were found to be not so high in rubber as California and Nevada specimens of the same species, averaging only 1.12 percent.

In rabbitbrush, as in guayule, rubber occurs in tiny definitely-formed masses in the cells of the inner bark and the outer wood. Because of this fact, neither rabbitbrush nor guayule can be tapped like the rubber trees. Some experiments have been conducted by the Bureau of Plant Industry on extracting rubber from rabbitbrush by the same method that is used with guayule. However, this process is not efficient with plants having a low rubber content. Before large-scale production of rubber from rabbitbrush is possible it will be necessary to develop more efficient methods of extracting the rubber and also develop methods of gathering, baling, and shipping the shrub. It will also be necessary to determine what time of year to harvest in order to get the highest percentage of rubber and to make surveys to determine both where the greatest numbers of shrubs are available and where the shrub has the highest rubber content. The U. S. Bureau of Agricultural Chemistry and Engineering is now proceeding with a project to determine the best methods for extracting rubber from rabbitbrush.

Other plants which grow in Utah and which are known to produce large percentages of rubber are milkweed, (*Asclepias*), Colorado rubber weed or pingway (*Aplopappus*), Indian hemp (*Apocynum*), goldenrod (*Solidago*), and milkweed (*Lactuca*). The *Lactuca*, *Asclepias*, and *Apocynum* produce rubber in latex form and the product is somewhat inferior in quality.

From 1914 to 1916 experiments were carried on at this Station by Dr. John A. Widtsoe and Professor C. T. Hirst on the extraction of rubber from the showy milkweed, *Asclepias speciosa*, Indian hemp, *Apocynum cannabinum*, swampy milkweed, *Asclepias incarnata*, prickly lettuce, *Lactuca scarola*, and decumbent milkweed, *Asclepidora decumbens*. Field trials were conducted to determine the yield and growth characteristics of the

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Drying Fruits and Vegetables for Home Use

By Drying, Products from the Home Garden May Be Preserved for Winter Without the Use of Sugar or Other Scarce Materials

By A. L. STARK
and E. L. MILLER

THE goal of the national and state-wide effort to encourage the production of food at home is to have every rural and farm family supply its own food needs during the growing season and during winter months as well. To fulfill the requirements of winter needs in fruits and vegetables some form of storage or preservation will be necessary. It is the purpose of the following discussion to explain a satisfactory and inexpensive method of home preservation of Utah fruits and vegetables.

Advantages of Drying Preservation

This year when our war production effort is entitled to first consideration on all industrial and material facilities, the practice of drying as a method of preservation has patriotic significance because of its simplicity, economy and lack of competitive demand for essential materials that are necessary when canning is employed. Drying has a decided advantage in that the processing procedure is simple and the weight and volume of the finished product are considerably reduced and less space is required for storage. There is also less loss or spoilage in well dried products that are properly handled and stored after drying.

General Information

When fruits and vegetables are properly dried enough of the water is removed to inhibit growth of molds and other organisms and to insure keeping qualities as well as preserve as much of the food value, natural flavor, and cooking quality in the product as possible.

In general, rapid drying will produce better cooking qualities than when slow drying is employed. The rate of drying may be increased by raising the temperature of the surrounding air or by increasing the air movement. For each 27° F. increase in temperature the rate of drying is approximately doubled. There are definite temperature limitations, however, beyond which an increase will result in injury to the product. In fresh material temperatures much above 175° F. cause bursting of the cells with the consequent loss of food value and a depreciation in the general appearance and quality of the product. Initial temperatures that are too high also cause rapid drying and hardening of the outer surfaces thereby sealing



in the water in the inner tissues and thus slowing down the ultimate rate of drying. This condition is called "case hardening" and may be brought about by the improper use of an electric fan as well as by high temperature. The maximum rate of drying is dependent upon the movement of water from the inside of the tissue to the surface and often treatments that are applied to accelerate the process result in final retardation. Moderate temperatures and air movement are more satisfactory than extremes when rapid drying is desired.

Fruit Drying

Sulfuring. To obtain maximum quality in dried fruits it is necessary to stop life activities in the tissue as soon as possible after harvesting. The use of sulfur dioxide for this purpose is universal in commercial practice. Practically all dried apricots, peaches, pears and apples on the commercial market are treated with sulfur to improve their keeping qualities, appearance, and food value. Sulfured fruit retains its color and flavor and is less subject to insect infestation and subsequent souring than fruit not treated.

The usual method of treatment is to burn a good grade of clean sublimed sulfur or sulfur powder in a small, clean, shallow, metal pan which is placed inside an air-tight box or compartment containing the fruit. A small air hole of one-half inch in diameter near the pan containing the sulfur is necessary for proper burning. In commercial practice in California 4 to 5 pounds of sulfur per ton of fruit is the usual amount used for apricots, nectarines, and peaches. With pears the amount is considerably greater, ranging from 10

to 15 pounds per ton of fruit. To prolong the burning period at least 2 pounds of sulfur should be used with small quantities of fruit.

The period of treatment varies from 3 to 4 hours with stone fruits, and up to as high as 30 hours for pears. There is no need to worry about getting too much sulfur dioxide in the fruit, but it is well to stay within the periods recommended, because they have proved to be the most satisfactory. Although fruit can be dried without sulfur treatment a far superior product will result from its use.

Little equipment is necessary except trays on which the fruit is placed for sulfur treatment and an air-tight box or compartment. The trays may be made from pieces of wooden apple boxes or other similar light-weight material. The size of the trays can be adjusted to fit the box or container in which the sulfuring is done. The dimensions of the trays illustrated in the figure are 18x24 inches. The two strips nailed on either side of the trays serve to give them rigidity and hold them apart when stacked upon each other in order that the sulfur can penetrate to all the fruit. The box or container in which the sulfuring is done must be as near air-tight as possible and large enough to hold the trays with some three inches of space at the sides and top for air circulation, and with sufficient room on the ends for burning of the sulfur without injury to the wooden trays.

A large packing box, covered with roofing paper or over which a tarpaulin is drawn during sulfuring, is highly satisfactory for home use.

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Address correspondence regarding material appearing in these columns either to the editor or to the author.

More detailed information on the subjects discussed here can often be found in Station bulletins and circulars or may be had through correspondence.

Agricultural Experimentation and the War Effort

AGRICULTURAL research throughout the country is being organized to meet the needs of the nation in the war effort. The United States Department of Agriculture, together with the state experiment stations, is making a vigorous attack on several problems that are of vital importance in this emergency.

Every effort is being made to furnish the information necessary to aid farmers to attain the production goals set up in the Food for Freedom Program. Detailed analyses are also being made to determine what the production goals for Utah should be in 1943. These involve a study of our production capacity in every community in the state, and also an estimation of the increased production that may safely be expected through increased efficiency. Experiments conducted in years past have indicated in many cases, how and to what extent the efficiency of production may be stepped up. For example, at the Dairy Experimental Farm milk production within the same herd was stepped up 44 percent through the adoption of improved methods of feeding and management. Experiments in other fields have likewise furnished information that will now assist in attaining maximum productivity for the war effort.

A vigorous effort is being made by the Department of Agriculture to determine the feasibility of producing rubber-bearing plants in the United States, and also in the tropical countries of Central and South America where the rubber tree is native. The production of synthetic rubber from grains and other farm products is also being investigated with promising results.

CHANGES IN FLOUR DURING STORAGE

Temperature and Grade Determine Storage Qualities of Flour

By J. E. GREAVES

FLOURS increase in bread-making properties with storage as a result of ripening changes brought about by the action of enzymes on the carbohydrates, fats, and proteins. There is an optimum time of storage for best results, after which there is a deterioration of the flour. The time required to reach this optimum depends upon at least two factors:



(1) the specific flour
—low grade flours

reach their optimum sooner and then deteriorate quicker than do high patent flours; (2) the temperature. Flours kept at high temperatures reach the point of optimum aging and then commence to deteriorate quicker than do flours kept at lower temperatures.

These conclusions are the results of a study conducted by the Department of Bacteriology and Biochemistry to learn the changes occurring during the aging of flour in Utah. In this experiment 13 fifty pound sacks of flour were stored for three years. During this time the flour was analyzed at intervals for: moisture, water soluble phosphorus, alcohol soluble phosphorus, hydrogen ion, amino nitrogen, soluble sugars, water absorbing powers, and the quality of bread produced from the flour. The moisture content of the flours varied from 7.7 to 8.2 with an

average of 8 percent. Moisture was lost from flours containing the larger quantities and gained by the flours containing the least so that by the end of three years the moisture content of all flours approximated 8 percent. There was nearly twice as much ash in some flours as in others. This was owing to two factors: (1) The nature of the flour (highly milled flours were low in ash compared to others not so highly milled). (2) The ash content of the flour was a function of the ash content of the grain. The phosphorus, calcium and magnesium content also varied. The highest phosphorus-carrying flour contained 54 percent more phosphorus than the lowest. The milling of the flour removed 63 percent of the phosphorus and 90 percent of the calcium contained in the wheat. The calcium-phosphorus ratio in the wheat was 1 to 2.2 and in the flour 1 to 3.8. Hence, the milling of the wheat not only removed great quantities of minerals but it disturbed the nutritive ratio of calcium and phosphorus so that malnutrition would result more quickly than it would if whole wheat was used unless the flour was supplemented with proper mineral-carrying foods. The mineral content of the flours varied during storage only to the extent of the moisture changes.

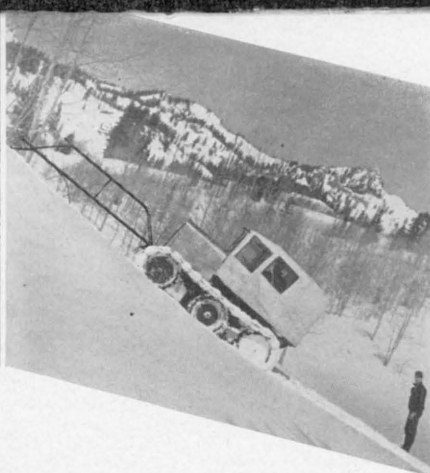
The water-soluble phosphorus of the flour increased and the alcohol soluble phosphorus decreased as the flour aged.

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With shortage of tin and sugar for the canning of fruits and vegetables, it is probable that a considerable volume of these perishable products will have to be preserved by dehydration, freezing or other processes. Rather extensive investigations are already well underway to determine how foods may best be preserved by these methods, and the information will be available to assist the housewife in the home preservation of foods, as well as to assist those in the commercial business of canning or other methods of food processing. Furthermore, dehydrated foods are needed for shipment to our armed forces, wherever they may be, and also to Great Britain and other nations under the Lend-Lease program. It is much easier to preserve dehydrated than fresh foods, and less space is needed for shipping. This is an important item at the present time.

The war has also emphasized the importance of determining the ways and means of best preserving the nutritive values of foods during the processes of harvesting, marketing, storage, and cooking. It has been determined that many of the common methods of food handling both at home and in the military camps are wasteful and destructive of certain essential vitamins. Investigations are now underway in practically every state agricultural experiment station to determine how to prevent these losses during this critical time. These investigations are being conducted cooperatively and are being coordinated through the Office of Experiment Stations in the U. S. Department of Agriculture.

The Utah Agriculture Experiment Station is cooperating with the U. S. Department of Agriculture and also with other state experiment stations in solving many of these problems.



The Utah Snowmobile

This Machine Provides Power Transportation
over Snow-Covered Areas and May Be of Use to the Army for Such Purposes

By GEORGE D. CLYDE

FOR many years attempts have been made to develop a power driven means of transport over deep and soft snow. In general, three types of equipment, all driven by gasoline engines, have been used.

The first to be tried was a common sled on wide runners driven by an airplane propeller. This machine worked fairly well on crusted snow but failed in soft, powdered snow and low temperatures.

Another type consisted of two wide runners with a metal worm placed between the runners so attached that it could be raised or lowered to grip the snow. The worm was driven by an air-cooled motorcycle engine. This machine was light and had positive action, but would easily stall in soft snow. It could not cross bare spots and experienced some difficulty on hard crusted snow. A modification of this type used a crawler track between the runners instead of a worm. This sled proved much more successful but it too experienced difficulty in very soft snow which is usually encountered in heavy timber. Furthermore, its load capacity was limited to two men and little baggage.

The third type of power-driven snow transport utilized a single caterpillar type track about five feet wide. Inside this track was housed the motor. Attached to the motor housing and track was a cab containing the driver's seat and the controls. Behind the cab was the steering mechanism which consisted of a large sled, shaped like a flat-bottomed boat. This sled acted as a rudder and through a power take-off from the motor the rudder sled guided the direction of the driving caterpillar tracks. This machine is called a snow-motor. It was developed by the United States Forest Service and a few are in use in the northwest. It is heavy and awkward and quite expensive.

None of the afore-mentioned machines combined lightness, positive power in all kinds of snow and low cost that is necessary for power-driven transport in mountainous, snow covered areas.

For several years different individuals have attempted to adapt the ordinary caterpillar tractor to snow transport. It proved too heavy and the snow would pack in the tracks and cause stalling or failure of the tracks. Guiding by stopping one track also proved unsatisfactory because the moving track would dig in the soft snow on a turn.

In an attempt to overcome the aforementioned difficulties, Walter Hansen, a mechanic of Ephraim, Utah, proposed and developed a split endless track to operate over rubber tires instead of the sprockets on the ordinary caterpillar. This split track prevented the snow from packing around the driving wheels and breaking the tracks. Six wheels were used to carry the tracks. The middle set of wheels were lower than the others and the entire machine tended to pivot on them. This permitted the guiding to be accomplished by a small runner placed out in front of the tractor, which runner was operated by the steering wheel in the cab. Equipment and passengers, if necessary, are carried on the guiding runners.

Utilizing the principles developed by Mr. Hansen and with his help, a complete snowmobile was constructed in the shops at the Utah State Agricultural College during the spring of 1942. This machine was used successfully in making the annual snow surveys over most of the watersheds in the north half of the state, and worked over elevations from 6,000 to 10,500 feet.

Snow surveys were made at Tony Grove Lake, Franklin Basin, Monte Cristo Ranger Station, Snow Basin, Head of Bear River, Head of Provo River, (10,500 feet) and Payson Canyon. In spite of the fact that there was no opportunity to test and adjust the machine before sending it into the mountains on the regular field surveys, little difficulty was experienced and it completed a trip of approximately 700 miles and returned from each survey under its own power. The snowmobile traveled approximately

(1) The method of transporting equipment to the snow line. The snowmobile is loaded and unloaded under its own power. (2) Snowmobile in action under full load. (3) Snowmobile moving up a steep slope

160 miles through all kinds of snow and over grades up to 25 percent.

The snowmobile was first used to make the Tony Grove Lake snow survey. This course is at elevation 8,250 feet and is reached over a grade which, in some instances, reaches 25 percent. The snow was soft in the timber and crusted in the open. It carried eleven men and their equipment weighing about 1,500 pounds. The round trip covered about 12 miles and was successfully made in about three hours' driving time.

The total area of the tracks is approximately 32 square feet and the maximum weight of the equipment with its load, exclusive of that carried as the guiding runners, is about 2,000 pounds. It is therefore evident that this equipment can be operated on very light snow as the weight is less than one-half pound per square foot. In very loose soft snow the tracks settled as much as twenty inches, but no stalling of the motor occurred.

The Utah motor sled was powered by a sixty-five horsepower Chevrolet motor and a 1½-ton rear end. The transmission was geared for a compound low speed. This gave ample power under the most adverse conditions.

It is believed that this type of equipment will solve the problem of power transportation over snow-covered areas and should be of great interest to the army as well as irrigation, power and municipal water users.

Individuals not now receiving Farm and Home Science who would like to do so, may have their names put on the mailing list by writing to the Agricultural Experiment Station at Logan.

Professor A. F. Bracken, formerly research associate professor of agronomy, has been appointed acting extension agronomist to take the place of Professor J. C. Hogenson whose death occurred March 17, 1942.

IN 17 of our western states, which comprise more than one-half of our national land area, production of food products now so urgently needed depends largely on irrigation. Food production in every western state, county and community can doubtless be increased this year by developing higher efficiencies in the control, conservation and use of irrigation water. Special attention to reduction of water conveyance losses, time of irrigation and improved methods of water application by irrigation officials and farmers will increase financial returns and also contribute substantially to our national needs. Today, more than ever before, the following questions on irrigation are pertinent.

Is your irrigation company delivering to its farmers 85 percent or more of the water it diverts from the rivers or the reservoirs? If not, why not? And what percent is delivered?

Are you storing in your soil 75 percent or more of the water delivered by the irrigation company to you at each irrigation? If not, why not? And what percent do you store?

Water Conveyance Losses

Some water is lost from the canals as it is conveyed from the rivers and the reservoirs to farmers. Losses occur through leaky headgates, by seepage into the soils through which the canals are constructed, and by excessive transpiration through vegetation growing along the canal bank. All of these losses, to some extent, can be controlled. Seepage through the soil is the major offender; it causes tremendous losses, and soils vary widely in permeability—the rate at which water flows through the soil. Irrigation companies may not this year be able fully to prevent seepage, indeed, many companies will do much if during this irrigation season they find where the large seepage losses occur, and then strive during the coming fall and winter to line the most leaky canal sections with clay or other impervious material, and thus reduce the losses.

Two factors, however, which influence seepage losses this year may be immediately controlled. Some canal companies permit obstructions in their canals to back water up for long distances thus causing unnecessary depth of water in the canals and excessive seepage losses; likewise, excessive growth of moss decreases the water velocity and causes sluggish flow, unnecessary depth, and excessive seepage losses.

A common misunderstanding among irrigation officials is that vegetation along a canal bank shades the water and decreases the losses. Actually, the transpiration losses through willows, trees, grasses

REDUCTION OF IRRIGATION WATER LOSSES

By O. W. ISRAELSEN

and weeds are far greater per unit length of canal than evaporation losses from the water surfaces would be if the willows, trees, grass and weeds were destroyed. Thus, immediate action is possible in reducing conveyance losses by preventing obstructions and moss growth in the canal and cutting out wasteful transpiration losses.

When to Irrigate

A large number of Utah's irrigation enterprises have little or no water storage in reservoirs. These companies must, therefore, divert their share of water from the rivers and creeks from day to day as it is available; they cannot hold it back until it is most needed on the farms. Likewise, the farmer is required frequently to "use the water or lose it" and so the "watering turn" in Utah has been developed. The practice of being forced to apply water in regular turns is no doubt the cause of much waste of water on Utah farms. It is, nevertheless, true that many irrigation companies that do have storage facilities, and that could save water until it is most urgently needed, convey water to the farmers on their demand when the need is trivial. A major cause of low water-application efficiency is the application of water to the land when it is already filled with moisture.

Efficient irrigating requires much more study of the moisture content of soils as a basis of determining when to irrigate. Much more use of the soil auger, in order to find the moisture content of the soil below the surface, will pay good returns. A small, sharp, steel rod probe will frequently serve the same purpose. Moisture inspection can be made more quickly in some soils with a steel rod probe than with a soil auger. The shovel is rarely adequate because it takes too long to dig deeply enough into the soil, but even more general use of the shovel is a means of inspecting moisture content which helps greatly to determine when to irrigate.

Plants are, of course, important indicators of the need for water, but sometimes plants actually suffer before the irrigator can tell by inspection of the plant alone that irrigation is really necessary.

How to Irrigate

Surprising as it may seem, yet it is true, that farmers using good irrigation practices seldom store in their root zone soil more than three-fourths of the water delivered to the farm. With more ordinary practices on the average farm, only one-half is actually retained in the soil two or three days after irrigation. Under care-

less irrigation practices, frequently as little as one-fourth or one-fifth of the water delivered to the farmer is held in the soil for crop production. There is no one formula of general application that will enable irrigators to apply water efficiently. Every irrigator deals with numerous invariables, such for instance as soil permeability, slope of land, size of stream, length of irrigation run, width of strip, smoothness of land surface, and nature of the crop grown. All of these variables influence water-application efficiencies.

There is no seepage loss from this concrete lined canal in Salt Lake County



The weeds and trees on the banks of this ditch are water wasters



There are many ways of measuring irrigation water. This picture shows the use of the Clansen-Pierce weir rule developed in Arizona for measuring the flow of a Utah County irrigation stream



Knowing the extraordinary importance of this year of *irrigating to win* by producing the greatest possible crop yields with given amounts of water supply, irrigators can increase water-application efficiencies by intelligent practices and by really "tending to business" during the time the water is applied to their lands.

Measurement of the water applied at each irrigation is a first necessity. Recent studies have shown that the major cause of low water-application efficiencies is the application of excessive depths of water in single irrigations. Six inches depth is usually plenty, and on shallow soils it is too much.

Careful control of the size of stream, avoiding excessively long runs, frequent transfer of water from one plot to another, careful inspection of depth of water penetration, use of runoff of high land to irrigate lower lands, or better still, prevention of runoff completely—these are some of the ways that irrigators can increase water-application efficiencies.

Other and equally important ways of

Backing up of the water as shown in this picture causes unnecessary seepage losses and should be avoided as much as practical



efficiently applying irrigation water to the land are these: the irrigator must avoid very long runs, 660 feet or longer; he must apply the water at a rate greater than the rate of infiltration into the soil; he must avoid excessive land slopes, 3 percent and higher, in the direction of the flow of the irrigation stream; he must not let the water concentrate into large streams on parts of the farm and thereby cause erosion and gullyng; and finally, he must measure his stream or get the water master to measure it for him; and keep records of the depth of water applied.

CHANGES IN FLOUR

(Continued from page 4)

Therefore, it is evident that during storage there was a slow breaking down of the complex phosphorus-carrying proteins and of the fat-carrying phosphorus. Inasmuch as yeast requires large quantities of phosphorus in its metabolism, it is probable that this is one of the benefits resulting from the aging of flour.

During the early period of storage autolytic changes resulting in protein cleavage may have been rapid enough to neutralize not only the acid produced but to have combined with some at first present. Later protein cleavage may have decreased relative to acid production with the resulting measurable increase in acidity, or what is more probable, the acids in the flour were used up in the normal metabolism of the cell enzymes. This latter supposition implies that the decrease in acidity is owing to the enzymic action which plays a part in the normal ripen-

ing of the wheat. Therefore, what we have is the normal ripening process, and it does not seem unreasonable to assume that this same enzymic process may occur during the storage period of flour. Possibly the ripening process is complete at the point of neutrality and the increase in acidity comes from decomposition. This may closely correlate with other beneficial changes occurring in flour, and if sufficiently studied may give an exact criterion for measuring changes in storages of not only grains and grain products but also fruits and vegetables.

In most of the flours the water-soluble carbohydrates increased owing to storage. Some flours remained unchanged and a few decreased in water-soluble carbohydrates. Two facts stand out from a study of the changes in the carbohydrates, as the result of storage: (1) There was a variation in water-soluble reducing sugars occurring in different flours, and (2) There was a tendency for the water-soluble carbohydrates to increase during storage, thus indicating a diastatic action. This increase in soluble sugars results in more available food for the yeast which breaks the carbohydrates down with the production of carbon dioxide, so necessary in the leavening of bread.

Water-soluble basic nitrogen decreased slightly in most flours as a result of aging. This may be owing to an actual condensing of protein resulting in a more elastic gluten. The water absorbed by the flours in the making of the dough varied widely with different flours. The highest absorbed 12 percent more water than did the lowest. There was a tendency for the water-absorption powers to increase with storage. Some of the flours yielded a loaf of greater volume after storage, whereas others registered a shrinkage. This variation may be owing to experimental differences as the bread tests were made by two individuals.

NEW PROJECTS

Water conveyance and delivery efficiencies in relation to methods of lining canals

This investigation, under the direction of O. W. Israelsen, is an attempt to find the most economical methods of lining for reducing conveyance losses in irrigation canals.

Onion improvement studies

This project, under the direction of L. H. Pollard, has for its purpose the development of onions resistant to thrips and with better keeping qualities.

Synovitis in turkeys

D. E. Madsen and Wayne Binns are studying the causes, symptoms and methods of control of this serious disease of turkeys.

Influence of green manures, farm manure, and commercial fertilizers on the yield and quality of various crops growing on the principal soil types of Utah

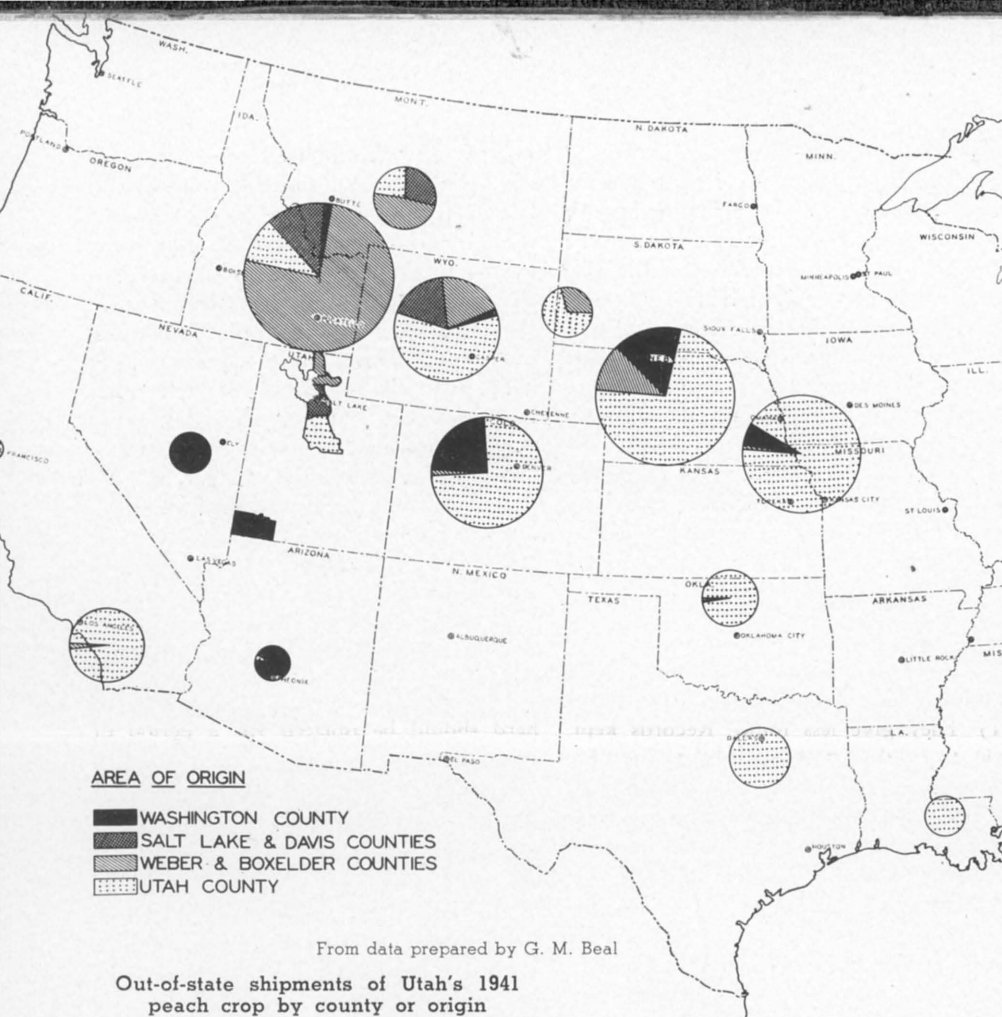
In this study D. W. Thorne and H. B. Peterson are attempting to determine the fertility needs of the principal soil types of the state.

NEW PUBLICATIONS

Bul. 301. Economic analysis of the Weber Central Dairy Association.
—W. U. Fuhrman, H. H. Cutler, W. P. Thomas.

This publication analyzes the factors that have contributed to the successful operation of the Weber Central Dairy Association, a farmer's cooperative marketing institution.

This bulletin may be obtained free by addressing a card to the Utah Agricultural Experiment Station, giving the number and series of the publication desired.



PROBLEMS OF MARKETING

(Continued from page 1)

A Summary of a Business Analysis of the 1941 Peach and Cherry Deals Handled by Cooperative Marketing Associations

Cost and returns from sale of peaches:

(1) The net returns to growers, f. o. b. shipping point in containers varied among the different marketing organizations from \$1.10 per bushel to only 77.2 cents per bushel. The average for all peaches was 86.2 cents.

(2) The deductions made by the marketing organizations for marketing services varied from 1.9 cents to 7.0 cents per bushel. The average for all was 4.4 cents per bushel.

(3) The average cost of marketing a bushel of peaches was 36.1 cents. This included 25.6 cents for freight and refrigeration, 7.5 cents brokerage and 3.0 cents for inspection and other. It does not include the containers or the association expenses.

(4) The quantity of peaches marketed per agency varied from 3,696 bushels to 37,115 bushels.

(5) The average net returns to the marketing associations for different size peaches were: 1¾ inch minimum 67 cents; 2 inch minimum 98 cents; and 2¼ inch minimum \$1.15 per bushel f. o. b. shipping point in containers.

Costs and returns from sale of cherries:

(1) The net returns paid by different

marketing agencies to growers varied from 98 cents to 60.6 cents and averaged 91.8 cents per 13 pound case f. o. b. shipping point in containers.

(2) The deductions made by the marketing organizations for marketing services varied from 15.8 cents to 1.6 cents per 13 pound case and averaged 4.3 cents. However, more services were performed by the agency with expenses of 15.8 cents per case.

(3) The average cost of marketing a 13 pound case of cherries was 29.3 cents. This includes freight, refrigeration, brokerage, and inspections.

(4) The number of cherries handled by different agencies varied from 10,708 cases to 56,775 cases of 13 pounds each.

(5) Cherries sold f. o. b. brought net returns to the marketing association averaging 8.42 cents per pound compared to 7.56 cents for those sold on consignment, 4.14 cents for those sold at auction, and 7.39 cents for all cherries.

(6) Bing and Lambert cherries brought the highest price per pound, an average of 7.63 cents, net to the marketing associations. Windsors sold for the lowest price, an average of 5.25 cents per pound.

Needed Improvements in Marketing Fruits and Vegetables

The marketing investigations show that fruit and vegetable growers of this state have both production and marketing problems to solve before Utah grow-

ers can successfully meet competition from other areas, and before farm income from fruits and vegetables can be substantially increased.

Production as it relates to marketing:

During periods of low prices there has been reduced production of most of Utah's fruits and a lowering of quality.

These marketing investigations show that many of the problems associated with the marketing of Utah fruits and vegetables originate in poor production and harvesting methods and practices. A program for increased yields and better quality is needed if Utah growers are to meet the competition from other areas. The success of a marketing program is in large measure dependent upon the success of the production program.

Marketing program:

On the basis of the investigational work done to date, it seems desirable to set up a general program and policies for marketing Utah's fruits and vegetables. The basis for such a program should include:

(1) The establishment of uniform grade standards and brands for Utah fruits and vegetables.

(2) The adoption of a few standard types and sizes of containers that will meet the demands of the various markets.

(3) Producers be paid for produce according to size and grade.

(4) A sales program be developed for marketing Utah fruits and vegetables. This program should include, among other things:

(a) Grading and packing according to the demands of the market.

(b) Adequately supplying the Utah and adjacent markets and developing specific outside markets for disposing of the surplus.

(5) A closer affiliation of local associations in marketing the crops.

(6) The handling of fruits and vegetables through the same marketing organization would increase tonnage, reduce costs, and enable an association to render more service.

(7) The marketing organization or organizations should have control of the grading and packing of the produce. This may be done either through use of central packing sheds, or orchard packing under the direct supervision of the association.

It is hoped that the analysis being made of Utah's fruit and vegetable industry by growers and other agencies will be helpful in developing a program for the state that will assist growers to place the production and marketing of these products on a basis to meet competition and give to the grower a larger return.

BANG'S DISEASE CONTROL

Higher Producing Dairy Herds Through the Elimination of Bang's Disease is the Purpose of New Program Sponsored by the State Board of Agriculture and the State Veterinary Association

By WAYNE BINNS

BANG'S disease, commonly known as infectious abortion of cattle, is an infectious disease caused by a specific germ, called *Brucella abortus*, which can be transmitted from one animal to another. The organisms that cause the disease live in the membranes covering the fetus and in the udder. These organisms can be found in the milk of infected cows and because of this many cities and towns require their milk supply to come from Bang's disease-free cows only. These restrictions are owing to a considerable number of undulant fever cases in man, which are known to be transmitted through the consumption of raw milk from diseased cows.

At the present time there is no known cure for Bang's disease. Many animals affected with the disease often acquire a complete immunity as a result of such infection. A few may continue to abort their calves.

Every case of Bang's disease must come directly or indirectly from another animal with the same disease. The disease is spread mainly from the diseased cow to the healthy animal by close association; also by healthy animals eating portions of the afterbirth, by licking the discharges from an animal that has come from an infected uterus, or by eating bedding or hay that has been contaminated with infected discharges.

Animals infected with Bang's disease are more likely to spread the disease during the time from two weeks before until six weeks after calving. The discharges that come from the vagina during this period contain large numbers of bacteria. The animal is a potential spreader at all other times.

When an animal becomes infected with the Bang's disease organisms there is no one definite set of symptoms. If the animal aborts once, but from then on carries her calf to full time and seems normal in all respects, that is not indication that she has become free from the infection. She will continue to give off large numbers of organisms at each time of calving and may continuously give off the organism in the milk.

Transmission of the disease by the bull through breeding, though not to be ignored, is of relatively minor importance. However, the bull can become infected, and an infected bull should not be allowed to serve cows free from the disease.

The blood test for Bang's disease is the most reliable means of determining the presence or absence of the infection in animals.

Animals infected with Bang's disease

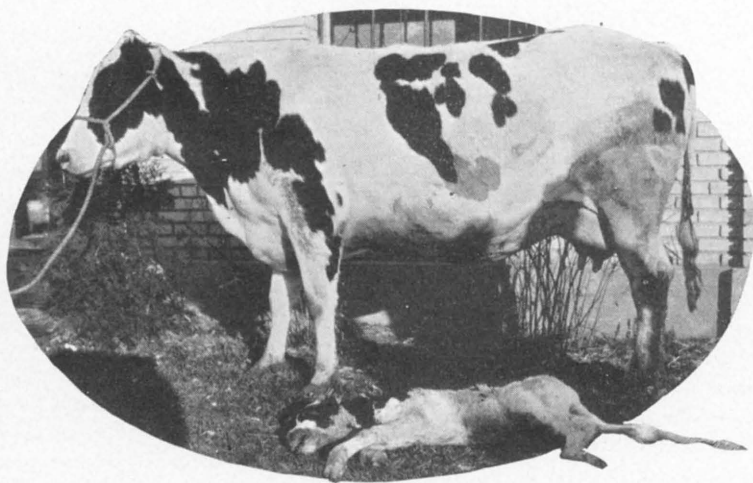
are less profitable to maintain because:

(1) They give less milk. Records kept over a period of years on infected animals and disease-free animals indicate that the average milk production is reduced 25 to 35 percent by the Bang's disease infection. (2) They produce fewer living calves. Approximately 85 percent of all abortions or premature births of calves are traceable to Bang's disease infection. (3) Mastitis or garget is more prevalent in cows affected with Bang's disease. (4) Such cows always show more breeding troubles. Sterility, shy breeders, and retained afterbirths are common. (5) Mature live calves are usually born weak and susceptible to diseases. Calves from Bang's disease infected cows are subject to calf scours, pneumonia, and enlargement of the joints. These calves do not inherit Bang's disease. They can be raised to maturity free from the infection, provided they are removed from the mother and other infected animals before they are six months of age.

How to Control Bang's Disease

(1). All animals over six months of age should be blood tested by a veterinarian and all reactor animals identified. There is no indemnity available at the present time for Bang's disease infected animals, so the owner may retain the infected animals in the herd if he desires. The milk sold from herds which contain infected animals must be pasteurized before it is used for human consumption. The owner should not sell the infected animals to anyone, except for slaughter.

(2). All calves the owner plans to keep should be vaccinated by a veterinarian between 4 and 8 months of age with strain 19 vaccine. This has proved a successful means of helping to control the disease. This vaccine should not be used on adult infected animals as it is in no sense a curative agent.



The calf of this cow affected with Bang's disease has been born dead

(3). Infected animals retained in the herd should be isolated for a period of two weeks before until six weeks after calving to prevent any possible spread of the disease to the noninfected cows. The pen in which the infected animal was isolated should be thoroughly cleaned and disinfected before other animals are allowed to enter.

(4). When animals are removed from the herd the owner should cull from those infected with Bang's disease. These animals must be sold only for slaughter. Replacements should come only from calves that have been properly vaccinated between 4 and 8 months of age.

If these measures are followed by the dairyman it will only be 5 to 6 years until he will have a herd immune from Bang's disease.

Utah State Bang's Disease Vaccination Program

The Bang's disease vaccination program for beef and dairy calves was drawn up by the Utah State Board of Agriculture and a committee of the State Veterinary Association, April 3, 1942, in an attempt to bring the disease under control throughout the state.

All cattle men (beef and dairy) who wish to have their calves vaccinated for Bang's disease between 4 and 8 months of age without cost to themselves may do so by complying with the following:

1. Owner agrees to place the herd under federal-state supervision.
2. All animals over six months of age, except steers, are to be blood tested and reactors identified with a Bang's disease reactor tag in left ear.
3. Owner may retain the reactors in the herd after they have been properly identified and he agrees not to sell them to anyone except for immediate slaughter.

(Continued on page 11)

DRYING FRUITS AND VEGETABLES

(Continued from page 3)

With this arrangement the loaded trays are stacked on the ground near the hole in which the sulfur is to be burned. After the sulfur is ignited the box is inverted over the pile of trays and covered to make it air-tight except for the small hole near the sulfur pan. At the end of the period of treatment the box is removed and the trays are placed in full sun for drying.

Sun drying. In commercial practice most of the fruits that are sulfured are sun dried. Bright hot weather is best and under ideal conditions the sulfur treatment is completed before noon in order that a full half-day of drying is possible immediately after sulfuring. The time of exposure to the sun will vary with weather conditions, degree of maturity and the kind of fruit dried. Ordinarily the larger and firmer the fruit, the longer the drying period required. Where flies and insects are a problem the fruit must be covered with screens or cheesecloth during drying.

Apples are commonly dried in the form of quarter-inch ring slices, pie slices, or cubes. Fruit at the proper stage of maturity is pared, cored and sliced and all bruised or discolored portions are removed before spreading on the trays. To prevent discoloration during preparation the fruit can be dipped five minutes in a very weak salt solution (3 to 5 tablespoonfuls per gallon of water) or can be kept in cold water. Where sulfuring is used the trays should be placed immediately in the sulfur box and treated 20 to 30 minutes before exposure to full sun. If dried in an evaporator the fruit may be piled up to 1½ inches in depth on the trays and drying begun at 130° F. and the temperature gradually increased to 175° F. Stirring during drying is necessary when the fruit is more than 2 layers deep. Fruit that is sufficiently dried has an elastic springy feeling when gripped in the hand.

Pears are usually harvested for drying before completely ripe and are then stored in a cool place to complete ripening. Since the skin is not removed, it is necessary to wash off thoroughly the spray residue before storing. The usual practice is to halve or quarter the well ripened fruit, cut out

the core, stem and calyx with a coring spoon and place on the trays, cut side up. A 6 to 72-hour period of sulfuring is recommended. Where longer hours of sulfuring are employed it is necessary to burn 3 or more pans of sulfur during the period. Longer periods usually give a more translucent and higher quality product than shorter periods. When the fruit is quartered the sulfuring period can be reduced to the minimum of 6 hours, providing it is ripe and not green or immature. A drying period in bright sun of two days followed by a 2 to 4 week period of drying in the shade where the trays are stacked in a pile gives a better product than where drying is completed in full sun. Pears properly dried are flat and flexible but not mushy.

Apricots which are firm and ripe give the most satisfactory dried product. Since they are usually dried with the skin on it is necessary to wash them before cutting. They are cut in half with a sharp knife around the suture and the pit is removed before placing the cut side up on the drying trays. Breaking the fruit instead of cutting often causes the dried product to flatten out into "slabs." After a sulfuring period of from 2 to 4 hours the fruit should be removed carefully to the drying yard to avoid spilling the liquid collected in the cuts. A drying period of from 2 to 3 days in bright sun will give a half-dried product. The final drying takes place after the trays are stacked. When the fruit reaches the flexible "kid glove" state it is ready to store.

Peaches for maximum drying quality should be fully ripe but not soft or bruised. They are usually prepared and dried like apricots with the skin attached, but the product is improved by peeling. The sulfuring period for peaches is approximately one hour longer than that for apricots and the drying period is at least two days longer. When completely dried the peaches will resemble apricots in flexibility.

Cherries. Sulfuring of light-colored cherries from 1 to 2 hours will improve the color of the dried fruit. For darker colored varieties sulfuring is unnecessary and in many instances under Utah conditions the fruit dries satisfactorily hanging on the trees. Under this treatment,

however, the fruit becomes very dusty and gives an inferior product. A better procedure is to pick and wash the fruit and dry on trays after pitting, or with the pits remaining in the fruit. Sweet cherries properly dried are comparable with raisins in quality and dessert characteristics.

Prunes. Italian prune, the most common variety in Utah, is best harvested for drying when it is fully mature and contains a maximum amount of sugar. The common commercial practice of sun drying is to dip prunes 5 to 15 seconds in a lye solution, (2 to 3 pounds of lye per 20 gallons of water) to crack the skin of the fruit. After dipping the fruit is thoroughly washed in fresh water and put on trays to dry. Sulfuring is not necessary for prunes. Sun dry at least 1 week, after which the trays may be stacked and allowed to finish drying. In cool wet weather evaporation with artificial heat may be necessary. The flesh of properly dried prunes will be firm and the pit will not slip when squeezed between thumb and finger.

Drying of Vegetables

Vegetables are usually dried with the use of artificial heat rather than sun drying. When artificial heat is employed the process is called "evaporation," and if the heated air is circulated by fans or other means the process is called "dehydration." The oven or top of the stove or range may be used for evaporation in order to prevent changes in composition, appearance and food value. Vegetables are usually blanched in hot water or steam before drying. The heat tends to arrest life activities at once and a better product results. Evaporation should always begin immediately after blanching. The use of a good thermometer is necessary in drying vegetables with artificial heat.

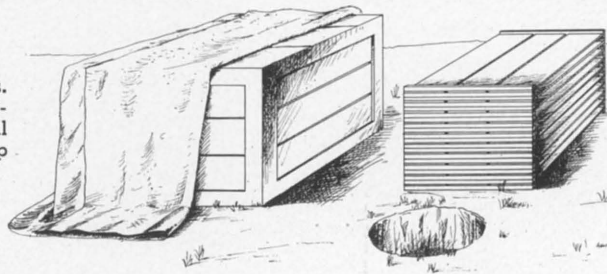
Vegetables Suitable for Drying

Many kinds of vegetables are dried on a commercial scale including beans, cabbage, carrots, corn, celery, potatoes, spinach, turnips, and several others for soup mixtures. Under Utah conditions many of these may be stored in the fresh state and drying is not necessary. Snap beans, peas, corn and celery are not as readily stored fresh as some of the others and therefore are often dried. Vegetables at the right stage of maturity for table use and of good quality are suitable for drying.

Preparation and Drying of Vegetables

Snap beans are prepared as for cooking and cut into from 1 to 2-inch lengths. Boil them 10 minutes in salt water (2 tablespoonfuls of salt per 1 gallon of

Equipment for sulfuring fruits. Sulfur is burned in pan in bottom of hole in ground. Soil around canvas edges will help hold in gas

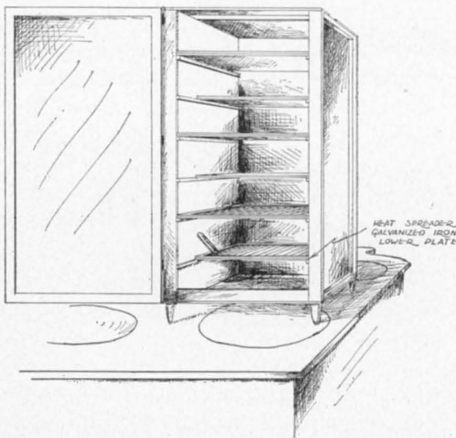


water); spread on wire trays and begin drying immediately at 130° F., increasing the temperature to 160° as drying proceeds. The usual drying period is from 4 to 7 hours but should continue until the beans are crisp.

Spinach for drying should be mature, yet tender and crisp. The younger leaves are not as satisfactory as the more mature ones. Thorough washing is necessary to remove all dirt before blanching over boiling water from 1 to 3 minutes or until the leaves are limp, but not soft. After draining off the excess water the leaves are spread on cheesecloth which has been placed over wire trays. The usual drying period ranges from 2½ to 4 hours at 140° F.

Peas for drying should be harvested and prepared as for immediate table use. After preparation is complete, blanch for 2 minutes in boiling salt water (2 tablespoonfuls to 1 gallon of water) and spread on trays about one-inch deep. Begin drying about 115° and increase to 140°. Four to 7 hours are usually required for completing the drying process.

Corn. The cream dried method is the favorite one used for drying corn in Utah.



Home made dryer for top of stove. Note thermometer on lower shelf. Thirty-penny spikes may be used to hold dryer above stove or it may be suspended from wall or ceiling

For highest quality the corn is harvested as needed rather than having it lay around before processing. The stage of maturity is the same as that necessary for table use. Four quarts of corn are cut from the cob and the cob scraped to get all the milk. To the corn is added 1 cup of cream or condensed milk, ¼ cup of sugar and 2 tablespoonfuls of salt. Boil the mixture

for 20 minutes on the top of the stove, stirring constantly to avoid scorching. After boiling the mixture is transferred to a shallow pan where it is stirred frequently while drying at 140° F. When the kernels break with a clean glass-like fracture the drying process has been carried to completion. The final stages of drying can be carried on in a cloth bag that is hung in the sun or a warm place.

Celery is usually cut into ¼-inch sections. The leaves and the stems are dried separately. After a 3-minute steaming period the pieces are drained and spread on a tray and dried at 125° F. for a short period. As drying proceeds, increase the temperature to 140°. The product is very brittle when drying has been completed.

Storage of Dried Products

The storing of dried products for a period longer than from one harvest season to the next is not recommended. A cool, clean, well ventilated dry place is most suitable for storage of fruits and vegetables. Moisture-tight and insect-proof containers are advisable but wooden or pasteboard boxes are often used for home storage.

RUBBER FROM DESERT PLANTS

(Continued from page 2)

showy milkweed; samples were taken to the laboratory for analyses, and trials on the extraction of rubber were made. It was found that this plant grows well under irrigation and that it contains about 3.15 percent rubber. The decumbent milkweed had 1.09 percent rubber and the swampy milkweed 2.63 percent. The Indian hemp and prickly lettuce gave no rubber. Further tests should be made on these plants.

Agencies in the Soviet Union since 1931 have been experimenting with a variety of dandelion, which they call kok-sagyz. This plant was first found growing at 6,000 feet in the Tien-Shan mountains in Russian Turkestan. This would indicate that it might be produced in climates with low winter temperatures. But up to the present it has been impossible to obtain seed of this dandelion for experimental plantings.

The fibers of some of these plants could be utilized in connection with the use of the plants for rubber. The rubber shortage is not the only one brought on by the war. Jute and other coarse fibers are now materially curtailed. A paper shortage looms because of inability to get pulpwoods from northern forests to mills. Investigations have been made into the usefulness of Indian hemp and the milk-

weeds, and the fibers of some of the milkweeds have been classed between flax and hemp in quality. These milkweeds are grown in eastern Europe and western Asia as a fiber crop. Tests in this country have shown that about 570 pounds of good quality bleached paper may be made from each ton of the dried plant material.

Preliminary studies by M. R. Miller of Nevada gave little indication of any useful byproduct from rabbitbrush. The fiber is largely destroyed in the grinding that sets the rubber free for extraction. Mr. Miller states that unless it should prove possible to extract useful essential oils, dyestuffs, or something else of value from portions of the plant it seems unlikely that byproducts will be found.

Some work has been done with a few of these plants under cultivation. Experiments conducted by the Bureau of Plant Industry at Fallon, Nevada, indicated that cultivation of rabbitbrush was not as promising as cultivation of guayule since the growth period is approximately the same length and the yields much lower.

Government agencies are now actively investigating the many problems connected with the commercial production of rubber from plants in the United States. The rubber crisis may ultimately be met by growing a large part of our rubber.

BANG'S DISEASE

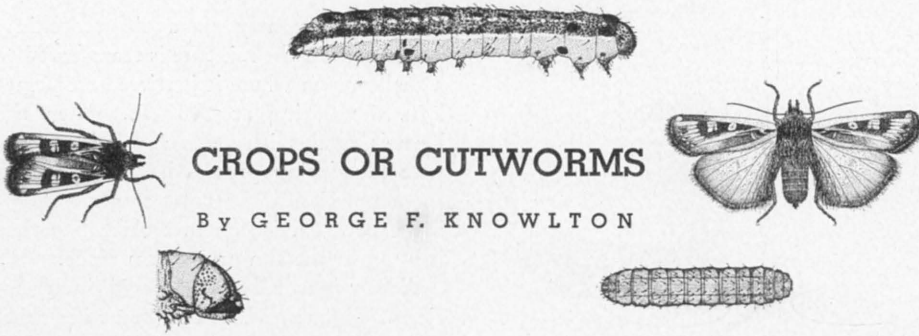
(Continued from page 9)

4. All calves between 4 and 8 months of age are to be vaccinated with Brucilla strain 19, by a veterinarian designated by the State Board of Agriculture or the U. S. Bureau of Animal Industry. The expense of the vaccine will be paid by the State Board of Agriculture and the U. S. Bureau of Animal Industry, cooperating.
5. All calves in the herd which are vaccinated and not registered animals will be identified with a "V" brand on the lower right jaw and a Bang's disease vaccination ear tag in the right ear.

All registered calves in the herd that have been vaccinated may be identified by the registration number if the owner so desires.

6. The state official will blood test a number of calves from each serial allotment of vaccine 30 to 60 days following vaccination to determine the effectiveness of the vaccine.

There is a similar program outlined for range and semi-range herds. These owners may vaccinate calves even though it is not feasible or practical to blood test the herd. However, this is advised whenever possible.



CROPS OR CUTWORMS

By GEORGE F. KNOWLTON

UTAH agriculture suffered serious and widespread cutworm damage last season. Not only were garden plants such as beets, tomatoes, cabbage, corn, lettuce and flowers frequently cut off just above, at, or below the surface of the ground in early spring but hundreds of acres of alfalfa, small grains and sugar beets were severely damaged by the night-feeding cutworms during late spring and summer.

Most cutworms pass through the winter as partially or full grown larvae. A few species hibernate as pupae in the soil, or as adult moths (also called millers) in protected places. With occurrence of warm weather the cutworms begin feeding in the spring and continue feeding until summer, or until larval growth is completed; at such time they go deeper into the soil, change to a brown pupal state within an earthen cell, later emerging as adult moths. Most of the common cutworms have only one generation a year; however a few complete two or three generations.

Upon emergence from the soil the adult moths mate, then the females lay their eggs upon plants or the bare ground. Each worm hatching from an egg seeks shelter in the soil during the day, usually coming to the surface to feed upon plants at night. Only a few species remain below the soil surface throughout larval life.

Cutworms are rather thick and smooth-bodied caterpillars with a few inconspicuous hairs. In color, they vary from blackish to pale, many species having conspicuous longitudinal bands or strips.

If the weather is cold or unsettled at the time of egg laying, cutworm outbreaks may be markedly reduced. Irrigation and storms, wetting the soil and bringing the cutworms to the surface during the daytime, result in increased insect parasitization of the cutworms with fewer adult moths subsequently occurring to lay eggs for the next generation.

Control—Many Utah farmers have made it a practice to irrigate infested fields to bring the cutworms to the surface. Blackbirds, robins, meadowlarks, seagulls, and various other insectivorous birds have fed upon the cutworms under such conditions, sometimes with decided effectiveness. Some farmers have employed a harrow or brush drag to destroy the worms on infested cropland.

Poisoned bait when properly and promptly applied usually gives effective and economical control of most common cutworms. In 1941 no serious cutworm outbreaks were observed on land recently baited for grasshopper control. The grasshopper bait proved to be effective against grasshoppers, variegated, army and other common garden cutworms. In several

counties suffering extensive cutworm attacks the government granted special permission for the use of federal grasshopper bait materials. Results of baiting generally were satisfactory.

With Utah residents requested to produce 30 percent more farm gardens, many more acres of tomatoes for canning, and increased production of nearly all other farm crops, extensive cutworm control doubtless will be needed in 1942 if the plants are to be protected, and the "food for freedom" goals achieved.

Poison bran bait will control most of the common garden cutworms.

The bait consists of: Bran, 50 lbs.; Sodium arsenite, 1 qt. (or white arsenic, 2½ lbs.); Water to make a stiff mash, 3 to 4 gal.

Mix the liquid poison with half of the water, then slowly add water to the bran while mixing until the proper consistency for bait is obtained. If white arsenic or paris green is substituted for sodium arsenite, mix such dry poison with the bran first (before the water is added) avoiding raising a dust in the mixing process.

Early spring baiting of cutworm infested land before or at the time tomatoes and cabbage are set out, or when other crops are planted, will kill the hungry cutworms before they can cause crop injury. Bait should always be scattered during a warm evening, about 20 pounds of wet bait being used on each acre of infested land. A second application of bait a few evenings later often is justified whenever cutworms are numerous in the soil. Most common cutworms emerge from the soil and feed above ground, or feed just below the soil surface during the night, when weather is warm. Thus the evening application of fresh bait is made at the time it will give greatest cutworm control.

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UTAH STATE AGRICULTURAL COLLEGE
LOGAN, UTAH

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